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ABSTRACT

This study assessed the learning environment resulting from a reformed first-year curriculum at the University of Michigan Medical School. First year medical students (N=435) provided demographic information and rated their academic and clinical preparation, aspects of the learning climate, and the level of their cognitive and behavioral skills for the years 1992 to 1995. The study suggests that all students value a strong academic program and learning interactions that are mutually respectful and supportive. Variables reflecting curriculum structure and student perceptions of the priority faculty place on education are important predictors of satisfaction with the learning environment. White women and minority men and women reported being uncomfortable approaching their teachers. (Contains 13 references.) (JPB)

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A Model of Student Satisfaction with the Medical School Learning Environment

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The professional school learning environment has been shown to exert a powerful and enduring influence on students' attitudes, behaviors, performance and well-being. As early as the 1950's, sociological research indicated that an institution's climate for learning influenced students' progress toward becoming physicians and shaped their long-term attitudes toward different medical specialties.[1] Stressors in the learning climate have been identified and their negative effects on students' social and psychological well-being, mood, and satisfaction examined.[2-7] Research also has linked students' perceptions of mistreatment in the educational environment to impairments in their physical and psychological health, their ability to interact with and learn from teachers, and ultimately their ability to offer compassionate patient care.[8-10]

This latter research presents some of the most compelling reasons for monitoring and improving the medical school learning environment -- to ensure that students' reports of mistreatment are addressed and that humane interactions among students, teachers, patients, and nurses predominate. Simmons' work, demonstrating that a caring school climate is the strongest predictor of students' caring ability[11], provides both good evidence that students build the foundations for compassionate professional-patient relationships in professional school and motivation for assessing the quality of the educational environment.

In this study, we describe our efforts to use environmental assessment to identify problems in the environment and serve as a catalyst for intervention. We used an evaluation process similar to that described by Huebner and Royer[12], in which we routinely collected information about the learning environment through a central evaluation office, analyzed it, and distributed the results widely. In this fashion, we were able to actively engage students, faculty and administrators in the process of monitoring the quality of the learning environment in our recently reformed curriculum.

The New First-year Curriculum

The University of Michigan Medical School implemented the first phase[1] of a new four-year program for the M.D. degree in August, 1992. Two years prior to implementation, the Dean had charged a committee composed of faculty and students to identify both the strengths and weaknesses of the School's previous educational program and to assess the overall climate for learning. Subsequently, the committee reported that both faculty and students felt the Medical School was an unfriendly place, with students in particular characterizing the environment as hostile and competitive.

To address this negative impression of the learning environment, faculty planners reformed the first-year program. The more traditional grading scale (honors, high pass, pass, and fail) was replaced with a satisfactory/fail scale to decrease competition among students for grades, encourage peer study, and accommodate students with diverse undergraduate backgrounds. Weekly quizzes were adopted to provide students with frequent feedback on their academic performance, enable the early identification of students experiencing academic difficulty, and mitigate the effect of high stakes, infrequent exams. The curriculum also was revised to facilitate active, rather than passive, learning and to offer more opportunities for student-faculty interaction. The number of formal lecture hours per week was limited to a maximum of fifteen and the amount of time allotted to active learning experiences and educational formats that foster student-faculty discussion was increased.

Methods

As part of an ongoing evaluation of the curriculum of the University of Michigan Medical School, students rate their academic and clinical preparation, aspects of the learning climate, and the level of their cognitive and behavioral skills on an annual survey administered at the end of each academic year. Before the curriculum change, a single global learning environment item was included on the baseline survey. In response to students' comments and to monitor learning environment reforms more closely, new items assessing the learning environment were added to

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[1] The Medical School's new curriculum was implemented in two phases. During the 1992-1993 academic year, the new first-year program was implemented. In 1993-1994, the new second, third and fourth year programs were implemented.

subsequent surveys. Currently, students rate not only the overall learning environment but also answer individual questions regarding how comfortable the environment is for men and women and for students of all races and ethnicities, the quality and amount of feedback provided, their perception of faculty involvement and interest in their education, and the educational program's ability to promote critical thinking.

Three years of survey data (academic years 1992-1993; 1993-1994; 1994-1995) were combined for these analyses to ensure adequate numbers of underrepresented minorities. The sample consisted of those respondents who provided demographic information (n=435), with special attention to two complementary sets of subgroups consisting of women (n=174) and men (n=263), and whites (n=244) and underrepresented minorities[2] (n=95). Seven variables were selected from the questionnaire to reflect aspects of the overall learning environment that students identified as influential (see Table 1).

T-tests were conducted to identify differences between gender and ethnic groups in mean responses to these variables. The existence of such differences would suggest that men and women or Caucasian and underrepresented minority students perceive the environment differently. Effect sizes (d) were used to characterize the magnitude and practical significance of these differences.[13] Unlike traditional *p* levels, effect sizes are not unduly influenced by sample size.

Regression analyses were performed as well because group differences on individual variables may provide only partial information about underlying differences in how subgroups define and perceive the learning environment. That is, it is possible that the same variables have differential impact on students' perceptions of the learning environment, differences that are not accurately reflected in means. For example, it may be that men do not find the level of faculty responsiveness to student concerns an important issue in their perception of the learning environment, whereas for women, it may be a critical factor in their satisfaction. This differential

[2] Underrepresented minorities = African American, Hispanic, Mexican, Native American, and Puerto Rican students in this sample (in accordance with the AAMC classification system). Asian students were removed from these analyses.

impact would not be reflected in differences in means, but in contrasting weights for this variable in a regression model that seeks to predict perceptions of the learning environment.

Therefore, multivariate linear regression procedures were used for each gender and ethnic group in an effort to determine the extent to which the best predictive model for each subgroup was similar to or different from the models for other subgroups and for the total sample. The seven predictor variables were entered into the equation in a stepwise manner to determine the best-fitting model for that group.

The regression model developed on each subgroup was cross-validated on the complementary subgroup to assess the stability of observed differences in the models. Differences between subgroups on the variable influencing satisfaction with the learning environment might be indicated by differing predictors in the model and by contrasting regression weights for the same predictor. However, because the predictors may share variance, similar predictive ability might be achieved by different combinations of predictors. Therefore, a key comparison was the amount of variance accounted for by a regression model when applied to the original subgroup and to the complementary subgroup. If the model predicts satisfaction with the learning environment equally well, the interpretation of any differences in the specific makeup of the subgroup regression models would have to include the possibility that these differences reflect relatively inconsequential statistical artifacts.

Results

Table 1 reports the means and standard deviations for the dependent variable, satisfaction with the learning environment, and the seven predictor variables. The means for the sample as a whole were uniformly positive, but variation was noted from item to item and by the gender and ethnic group of the students. Men reported being more satisfied than women on a number of items. Specifically, men indicated they were more satisfied with the learning environment overall; they also believed more strongly that the school was a comfortable place for people of all races and ethnicities and genders to learn (effect sizes (d) between 0.5 and 0.8). Men gave a slightly more

positive rating than women to the priority faculty place on student education and the faculty's responsiveness to student concerns.

A similar pattern of subgroup differences was identified when comparing underrepresented minority students and white students, with the white students reporting greater satisfaction overall with the learning environment and five of the seven "predictor" items. Differences in ratings of these two groups were greatest ($d>0.8$) for the item measuring how comfortable the school was as a place to learn for people of all races and ethnicities, with underrepresented minorities reporting much less satisfaction. White students were moderately more satisfied with the extent to which students received constructive feedback and the extent to which the school was a comfortable place for people of both genders to learn. Small differences in ratings were noted for satisfaction with the learning environment, the timeliness of student evaluation, and faculty responsiveness to student concerns. Across all subgroups, students gave similar ratings of the extent to which the overall educational program promotes critical thinking.

Comparisons of the stepwise regression equations for each subgroup and for the total sample indicated that there were some differences in the predictors included in the models and the weights assigned to them. However, cross-validation of the regression models based on gender and ethnic groups showed that the original total sample model and cross-validated subgroup models predicted the outcome "satisfaction with the learning environment" equally well. Correlations between observed student satisfaction with the learning environment and values predicted by the alternative regression models were nearly the same when comparing results for the entire sample and those of each of the subgroups. These findings suggest that a single regression model, including data from all students across the three years, was an adequate representation of the magnitude of variables contributing to all students' evaluation of the learning environment. Therefore, the regression model derived from the total sample was used.

Stepwise regressions of the seven items assessing aspects of student satisfaction with the learning environment for the entire sample showed that a subset of five predictors constituted an

adequate model, with an R^2=0.39 (Table 2). Students' rating of the school as a comfortable place for men and women to learn had a slightly greater influence (b = .24) than did the similar item addressing the comfort levels for all racial and ethnic groups (b = .18). The degree to which the curriculum promotes critical thinking and the timely evaluation of student performance predicted student satisfaction with the learning environment at similar levels (b = .16 and .20, respectively). The strongest individual predictor was the item related to student perception that faculty placed a priority on their education (b = .41).

The regression models for the subgroups differed in both the variables included as significant predictors and the magnitude of the regression weights for these variables. The custom models predicted subgroup satisfaction with the learning environment with varying degrees of success. The best fitting models were obtained for underrepresented minorities (R^2 = .46) and for women (R^2 = .45). The predictors did not fit as well for white students (R^2 = .38) or men (R^2 = .29). The regression equations for men and women separately share only one predictor, the priority faculty place on medical student education (b = .42 and .34 for men and women respectively). For women, additional predictors included items related to the amount of constructive feedback students receive (b = .16), the degree to which the school is a comfortable place for people of all races and ethnicities to learn (b = .25), the extent to which the overall educational program promotes critical thinking (b = .27) and the responsiveness of the faculty to students concerns (b = .22). The satisfaction of the men was predicted by items related to the degree to which the school was a comfortable place for both men and women to learn (b = .41), and the timely evaluation of student performance (b = .24), in addition to the aforementioned priority of medical faculty on student learning.

The regressions for the majority and underrepresented minority subgroups also shared only one predictor, which was the same one shared by men and women, the perceived priority faculty place on student learning (b = .39 and .47 white and underrepresented minorities, respectively). White student satisfaction was predicted by the extent to which the school was seen as a

comfortable place for both men and women to learn (b = .39), the extent to which the overall program promotes critical thinking (b = .24), and timely evaluation of student performance (b = .24). Underrepresented minority student satisfaction was predicted items related to the amount of constructive feedback students receive (b = .28) and how comfortable the school is perceived as a place for people of all races and ethnicities to learn (b = .55).

Although there are clearly differences between regression models for the various subgroups, the fact is that the regression model for both the complementary subgroup (e.g., the men's model applied to the women's data) and the model based on total group, fit the data for each subgroup nearly as well as did the custom model derived from that subgroup (Table 2). The relative interchangeability of these models allows the interpretation that the differences observed in the subgroup models are statistical artifacts rather than substantive differences in the dimensions that lead to satisfaction with the learning environment. It also supports a decision to treat all students as being equally influenced by the same characteristics of the learning environment when predicting satisfaction with the learning environment.

Conclusions

Our study suggests that all students (regardless of gender and ethnicity) value a strong academic program and learning interactions (especially with faculty) that are mutually respectful and supportive. Previous research on the medical school learning environment has tended to focus on the negative effect of stress and mistreatment on students' perceptions of the learning climate. This study extends the scope of understanding to consider additional factors that influence student satisfaction with the environment. These include the structure of the curriculum and positive interactions with faculty.

Our regression model for the total sample of students (Table 2) indicates that the variables reflecting curriculum structure (promotion of critical thinking and timely feedback) and student perceptions of the priority faculty place on education are important predictors of satisfaction with the learning environment. The small size of the differences between subgroup means (Table 1),

however, indicates that gender and ethnic groups will not be well distinguished by these variables. In contrast, the variables reflecting students' evaluation of the environment as a comfortable place for all gender and ethnic groups, although less prominent predictors of satisfaction, will discriminate among the subgroups, as indicated by the moderate to large differences in group means.

Separate regression models built on the subgroups of students initially suggest that satisfaction with the learning environment for men and women and for white and underrepresented minority students may depend on different characteristics of the environment. However, the fact that alternative models based on the complementary subgroup of students or on the total sample, predict satisfaction of each group almost as well as the original subgroup model indicates that the apparent differences among the subgroup regression models may not reflect substantive differences in how satisfaction is influenced but rather a considerable degree of covariation among the predictors.

We found striking the degree to which all students' perceptions of faculty interest in their education positively influenced their ratings of the overall learning environment. To the extent that good student-teacher interactions create the perception of faculty concern for student education, this finding may help to explain why men and non-minority students are more satisfied overall with the learning environment than women and underrepresented minorities. In focus groups, white men reported being comfortable approaching and interacting with the predominantly white, male teachers they encounter in their classes. Further, they attributed their unsatisfactory encounters with teachers to the teacher's idiosyncrasies. In contrast, white women and minority men and women reported that they were often uncomfortable approaching their teachers. These groups also were more likely to interpret off-putting behaviors as evidence of systematic bias. What our study suggests is that students' predominant interpretations of faculty behaviors influence not only the perception that faculty are concerned about their education, but also that the learning environment is supportive. In light of the research suggesting that a caring climate positively affects students'

ability to offer compassionate care, this finding supports efforts (already in place) to create opportunities for students and faculty to communicate about the learning environment and to redress issues that are raised in these forums. It furthermore supports efforts to identify and reward excellent teachers.

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Table 1

Mean (s.d.) for total sample, and gender and ethnic subgroups.

		Gender		Race	
Variable	Total	Men	Women+	White	Underrep. minority
Satisfaction with the learning environment.[3]	3.3 (1.0)	3.5 (1.0)	3.0 (1.0)**	3.4 (1.0)	3.1 (1.1)*
Students receive an appropriate amount of constructive feedback[4]	2.6 (0.8)	2.6 (0.8)	2.5 (0.8)	2.7 (0.8)	2.3 (0.8)**
Comfortable place for people of all races and ethnicities to learn	3.1 (0.7)	3.3 (0.7)	2.9 (0.7)**	3.3 (0.6)	2.7 (0.8)***
Comfortable place for both men and women to learn	3.2 (0.7)	3.3 (0.6)	2.9 (0.7)**	3.3 (0.7)	2.9 (0.7)**
Overall educational program promotes critical thinking	2.8 (0.8)	2.8 (0.8)	2.8 (0.7)	2.8 (0.8)	2.9 (0.7)
Timely evaluation of student performance	3.1 (0.7)	3.2 (0.7)	3.1 (0.6)	3.2 (0.7)	2.9 (0.7)*
Medical student education is a high priority for faculty	2.7 (0.8)	2.8 (0.8)	2.5 (0.8)*	2.7 (0.8)	2.6 (0.8)
Faculty are responsive to student concerns	2.9 (0.7)	3.0 (0.7)	2.8 (0.7)*	2.9 (0.7)	2.7 (0.8)*

Effect size of differences between group means: *small (.20 ≤ d < .5), **medium (.5 ≤ d < .8), and ***large (.80 ≤ d)

[3] The global learning environment item was scored on a 5-point scale, where 1=not satisfied at all, 3=moderately satisfied, and 5=exceptionally satisfied.

[4] The seven predictor items were measured on a 4-point rating scale where 1=Strongly Disagree and 4=Strongly Agree.

Table 2
Regression weights (95% CI) associated with seven predictors of student satisfaction with the learning environment for the total sample and each subgroup

	Total	Gender		Race	
Variable		Men	Women	White	Underrep. minority
Students receive an appropriate amount of constructive feedback	—	—	.16 (.00, .33)	—	.28 (.01, .55)
Comfortable place for people of all races and ethnicities to learn	.18 (.01, .35)	—	.25 (.07, .43)	—	.55 (27, .84)
Comfortable place for both men and women to learn	.24 (.06, .41)	.41 (.23, .60)	—	.39 (.21, .56)	—
Overall educational program promotes critical thinking	.16 (.05, .27)	—	.27 (.09, .44)	.17 (.02, .32)	—
Timely evaluation of student performance	.20 (.08, .33)	.24 (.07, .40)	—	.24 (.07, .41)	—
Medical student education is a high priority for faculty	.41 (.30, .52)	.42 (.29, .56)	.34 (.15, .53)	.39 (.24, .53)	.47 (.18, .76)
Faculty are responsive to student concerns	—	—	.22 (.01, .43)	—	—
R^2 subgroup model		.29	.45	.38	.46
R^2 cross-validated model		.28	.35	.33	.43
R^2 total sample model	.39	.32	.41	.37	.45